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ABSTRACT

This paper presents a study that: (1) documented the course of problems for borderline students in an undergraduate medical program; (2) compared documentation by the same tutors of weaker students with good students in the same tutorial group; (3) documented which of six dimensions (knowledge, problem solving, critical appraisal, clinical skills, learning skills, and personal qualities) caused these students the most trouble; (4) documented at what stage in the program specific dimensions are particularly troublesome; (5) identified what curricular units caused these students the most difficulty; and (6) examined whether problem students have difficulty with the same dimensions repeatedly, and if so, which ones. Findings indicated that problem solving, knowledge, and clinical skills were the dimensions with which problem students encountered the most difficulty. Newness to the educational system and confusion about bases of evaluation also caused students problems. Also, the complexity of the patients seen and the broad scope of the content caused problem students more difficulties. It was found that in most cases the problem students did encounter repeated difficulties with the same dimensions. Educational recommendations are presented. Contains 20 references. (GLR)

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An analysis of students who encounter repeated difficulties in a problem-based medical school

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An old saw in education is that 10% of the students take up 90% of the teachers' time. While the percentage of medical students barely passing or failing is probably smaller than 10% [1], faculty must direct more of their energies toward them. However, what happens to these students or where they encounter difficulties is generally not documented in the professional literature. Instead most researchers have looked at personal characteristics [2], admissions credentials [3,4] and predicting success in medical school [5, 6, 7]. This paper will plot the weaker students' course in a problem-based curriculum. Since the evaluation forms in this school request a description of behavioral characteristics along the same dimensions throughout the program, areas of concern become readily apparent to any reader of the record [8,9].

An analysis of the pattern of difficulties encountered by weak students allows us to test the hypothesis that students have trouble with the same dimensions, such as knowledge or clinical skills, repeatedly. If this hypothesis is true, and if weaknesses are remediable, then it would be to the students' advantage for such evaluation data to be available for subsequent faculty[10]. Information sharing is consistent with current learning theories, that is, providing teachers with background knowledge for proper planning on behalf of students[11]. Yet, an AAMC survey indicated that 75% of all responding faculty expressed concern about the lack of flow of information from one learning unit to another, with this being one of the most serious evaluation system problems[12].

Objectives.

1.) document the course of problems for borderline

students.

2.) compare documentation by the same tutors of weaker students with good students in the same tutorial group. Within one group is the amount written and its specificity different for weaker students compared to of the other students in that same group?

3.) document which of six dimensions (knowledge, problem solving, critical appraisal, clinical skills, learning skills, personal qualities) cause these students the most trouble.

4.) document at what stage in the program are specific dimensions particularly troublesome.

5.)identify what curricular units cause these students the most difficulty.

6.) document if problem students have difficulty with the same dimensions repeatedly, if so, which ones.

Description of Undergraduate Medical Program. The main forum for preclinical learning at this school consists of problem-based discussions in groups of approximately six students with a trained faculty tutor[13]. The group stays together for a learning unit (≥2 months) and then students are reassigned to the next unit. There are five preclinical units, with students continuing to meet in small group tutorials during the six clerkship rotations. As faculty at this school do not have access to previous student evaluations, the same minor problems may be identified repeatedly, without improvement[12,8] . Among the various tutor roles, important evaluation tasks include collation of all assessment data from that

students on the same six dimensions (problem solving, knowledge, clinical skills, critical appraisal, learning skills and personal qualities) throughout the program. Clinical work is an integral part of the entire program. The evaluation form is non-numerical, requiring a narrative description of the student's positive and negative behaviours in each of the six dimensions. Descriptors for each of the six dimensions are listed on the evaluation forms. A final grade (satisfactory (S), middle track (M), i.e. may proceed to the next unit but requires help in specific areas, or unsatisfactory (U) is assigned by the tutor. M or U grades result in a formal remedial process. At the present time this school does not have a student progress committee that reviews all student evaluations. Only the student's advisor receives all evaluations for his/her advisee.

Method

Data source. For the purposes of this study, students with repeated problems were defined as those who received $\geq$ 1 U's, $\geq$ 2 M's or [$\geq$ 1 U +$\geq$ 1 M]. These we call problem students. In six recent graduating classes (N =600), 13 problem students were identified. Twelve out of 13 of these students were admitted under regular admissions criteria, none of them being of disadvantaged educational background. These 12 had no identifiable characteristics at admissions that would put them at risk. The last student had been a medical student in another country and this medical school was closed by a repressive government. This student, as a refugee, was accepted on humanitarian grounds after

a close examination of his previous record. All of the problem students eventually graduated.

For each of these 13 problem students, a register assembled a package of photocopied evaluations consisting of that student's 11 evaluations (from the 5 preclinical units and the 6 clerkship rotations), plus those of his/her tutorial peers from each of these 11 groups. Evaluations from each tutorial group were placed together (with student, tutor names and unit identifiers eliminated). These packages were numbered so that the reviewers were blinded as to which unit or discipline they were reading, the sequence, the student status (problem or peer), and the final grade (S, M or U). The tutorial peers were included so that comparisons could be made among students in a group and to control for any tutor bias.

Evaluation criteria. A priori, the two reviewers (a clinician and an educator both with experience as tutors and unit coordinators) developed rating criteria, and an appropriate, objective rating form. Criteria for rating the individual concerns were based upon the severity and the number of concerns raised. These reviewers pretested the criteria and their ability to apply them on evaluations not used in the study.

Review Process. The evaluations for each tutorial group were reviewed at the same time. Reviewing the evaluations involved: reading the tutor's comments under each of six dimensions, documenting those dimensions in which the student was apparently having difficulty, if any, rating the level of each concern under

each dimension, assessing whether the quality or quantity of documentation of each dimension differed from those for the rest of the group and assigning a final grade. Quality of statements refers to the degree of specificity of statements and whether clear examples of behaviours were given. These data were recorded on a separate rating form for each of the original tutor's evaluations. As a total 630 evaluations were reviewed (13 target students x 11 units x (4-6) students per group), the 133 evaluations for these problem students comprised a subset of a larger study.

Previous studies[8,9] with this data set revealed that 1.) there was good inter-rater reliability among the two reviewers (Kendall's Tau = 0.79; and 2.) there was good agreement between the independent reviewers' and the original tutors' evaluations (Kappa = 0.68,$\pm$ 0.09).

Results

Amount of documentation. The amount of documentation (greater than peers, less than peers, no difference) for each of the 6 general dimensions was compared for all 3 final grade (satisfactory, middle track and unsatisfactory) categories. No quantitive nor qualitative differences were found in the amount of documentation given to the problem students compared to the satisfactory ones.

Comparison of tutors and reviewers on distribution of concerns. Our evaluation forms require tutors to check dimensions of concern for middle track students only. For their 19 M evaluations, the tutors identified 29 areas of concern while the

reviewers identified 72 areas of concern for the same evaluations. 47/72 (65%) of these concerns were of moderate to major severity. An example of a moderate concern was recorded on a problem student evaluation for clinical skills, " With some difficulties she is able to get appropriate history and do simple physical examinations. Again, she is well below the average medical student. " For the 39 M and U evaluations identified by the reviewers a total of 151 concerns, of which 122 (81%) were moderate or major concerns were identified. This number cannot be compared with the tutors since areas of concern were not labelled for all of these students.

Our previous work [8,9] indicates reviewers identified many more concerns than they acted upon in terms of awarding an M or U grade. The rest of the data reported here use only the concerns identified by the reviewers. These will concentrate on a close look at the problem students while giving data about their cohorts for a comparative perspective.

Course of difficulties. Figure 1 shows that these problem students had an average of 1.2 concerns per evaluation while their cohort had an average of 0.2 concerns per unit. During the preclerkship phase, the problem students encountered the most concerns in the first and to a lesser extent in the last preclinical unit. Most of the concerns raised in units 1 and 5 were moderate to major. These problem students had fewer separate concerns during the middle preclinical units. The pattern for the rest of their cohorts is having more difficulties in the first

unit and then for the number of concerns to decrease throughout the rest of the preclinical units". In the preclerkship most concerns are of minor importance compared to moderate and major importance (4:2:1). In the clerkship the severity of the concerns becomes more evenly distributed among the three levels (3:2:2). However, if moderate and major concerns are collapsed, then there are 4:3 moderate and major concerns compared to concerns of minor importance. Table 1 gives individual student data in terms of the number of times each one had difficulty with each dimension and other data about these students. Table 2 summarizes the dimensions of difficulty in terms of preclerkship and clerkship performance and gives the cohort comparisons.

Students take clerkship rotations in different order thus we can look at them in calendar order compared to specific disciplines to see whether it was timing in clerkship or discipline which caused the most problems. When the rotations were looked at in calendar order, there does not appear to be any pattern of problem evolution. It is the disciplines themselves which appear to cause problems. The Medicine clerkship caused the students the most problems with surgery causing the second most problems.

Dimensions of concern. The pattern of difficulties is similar for problem students and their cohorts. For the cohorts, problem solving and clinical skills causes the most difficulties throughout with knowledge also causing many concerns in the clerkship. As Figure 2 shows for these problem students problem solving, knowledge, and clinical skills cause the most difficulties

throughout. In terms of moderate and major concerns, the problem students encounter most difficulties in problem solving and knowledge. Table 3 shows the number of concerns per dimension per unit.

Repetition of same concerns. Table 4 shows the repetition of the same concerns by dimension with the same students. Among these 13 problems students, the same dimensions were identified as problems twice with the same student 20 separate times. All but 2 students had trouble with the same dimensions at least twice in the program, with 10 of them having the same problems at least three times.

For the student who had trouble with problem solving seven times and knowledge four times his evaluations consistently raised the same types of concerns within each dimension. For example, on the last preclinical unit, this student's problem solving evaluation read, "... consistently had difficulty in dealing with the initial aspects of problem-solving. He could not identify issues and set them in some sort of priority. As a result, his discussions of a problem were either completely unfocussed or took an inordinately long time to become clarified". This same student's evaluation for problem solving on a clerkship was, "able to obtain the necessary details at history and physical examination, but unable to synthesize and therefore, unable to prioritize problems. Cannot problem solve at clinical level." The comments for knowledge for this student show consistency also. For a preclinical unit, the tutor wrote, " already had a fairly wide

knowledge base entering into this unit and expanded it to some extent. However, there was repeated concern expressed that his knowledge was superficial and that he had difficulty tying together knowledge from different areas to deal with a specific problem. This concern remained at unit end". In a clinical unit, the knowledge evaluation for this student read, "has probably a satisfactory knowledge base but the knowledge is fragmented and has difficulty applying the information".

One student had trouble with the same five out of six dimensions four times out of 11 units. The only dimension in which she did not encounter repeated difficulties was personal qualities. Another student encountered difficulties with problem solving, clinical skills and personal qualities in 5 out of the 11 units. A third student encountered difficulty with five out of six dimensions at least twice. The dimension in which he did not encounter difficulties was critical appraisal.

Having trouble with one dimension tends to lead to concerns with other dimensions. As other concerns are identified such as in knowledge or problem solving, concerns in personal qualities tend to escalate. All but one problem student had at least one difficulty with personal qualities during medical school. There are very few concerns with personal qualities in the cohort after Unit 1. Concerns with knowledge were also correlated with concerns in problem solving and to a lesser extent learning skills. For example, with one student, knowledge deficiencies were identified as causing difficulties in problem solving in Units 1, 4 and

surgery. The preclerkship tutors both stated that they thought that this student's lack of skills in problem solving would probably not be a concern once her knowledge base became adequate. In Unit 1 the tutor wrote for problem solving, " She has difficulty summarizing and integrating knowledge around a problem, thus she does not demonstrate good problem solving skills". Her tutor in Unit 4 wrote, "her poor knowledge base or her inability to link knowledge with hypotheses leads to very poor hypothesis generation". This same student had repeated difficulties with learning skills, as stated by her tutors, due to her inability to assess her own knowledge base and her own performance. Her tutor for surgery stated, "She thinks that she can identify deficiencies herself, but I have no evidence that this is so. However, when deficiencies are pointed out to her she responds appropriately. (Learning skills in this program generally means self-directed learning.)

Discussion

There seems to be specific points in the program when most concerns emerge. As expected and also found with their cohorts, in the first unit many concerns were raised. So much of what the students are being evaluated on, and the whole system of learning is new for them. During this unit the students are first exposed to the demands of small group, problem-based learning including the acquisition of material on their own. Others have documented that it takes some students awhile to get used to this type of learning 14. The objectives of this unit include an emphasis on three

perspectives of biology, including an understanding of basic pathophysiology concepts such as inflammation and infection; population including concepts of epidemiology and health prevention; and behavior including concepts of development and motivation. For many students it may be the first time they are thinking about some of these concepts. During the middle three units of the pre-clerkship phase, the problem students' and their cohorts' records indicate fewer concerns. It seems that the students learn what is expected of them in this preclinical, or classroom phase of their learning. These are also the organ system units in which the greatest emphasis is placed on the acquisition of biological knowledge. Then during the last preclinical unit, an integrative block, the number of areas of concern escalate again. This unit may be difficult for these somewhat weaker students as the format of learning changes here, because the students have to access patients on their own to form the basis for their tutorial discussions. There is a greater emphasis on the three perspectives again.

As with their cohorts, during the clerkships, more difficulties are identified. Most of the concerns are raised in medicine and surgery. Medicine and surgery are very intense experiences with supervisors working closely with the students. These clerkships allow repeated opportunities for 1-1 student supervision. The complexity of the patients seen and the broad scope of the content may also cause these problem students more difficulties. In both medicine and surgery many concerns were

moderate and major. In the cohort sample the most concerns were raised in family medicine and psychiatry.

Problem solving, knowledge and clinical skills are the dimensions in which the problem students encounter the most difficulty. These dimensions can be remediated. Students lacking a good knowledge base can acquire content independently through studying materials in texts or other library resources or through faculty contact. Improving one's knowledge base may also enhance problem solving skills since they are likely content specific[15,16]. Students can also be assisted in approaches to problem solving, such as gathering data in a systematic way, asking questions which test specific hypotheses, avoiding early closure, or learning to be more organized. Clinical skills can be learned and improved provided the students obtain proper feedback on their clinical work. This feedback should be specific, relate to behaviors and constructive. Students can also learn clinical skills through modelling.

Repeated difficulties with potentially remediatable dimensions gives support for why previous evaluation information should be made available to faculty 10. Perhaps if the students had been more forthcoming in discussing their own shortcomings, or if the faculty had known about them, the students could have been given more remedial guidance. Perhaps if this school had had a student progress committee whose function is to review all student evaluations and to look longitudinally at the students who encounter repeated problems, we may also have remediated some of

these problems earlier. We believe that early identification and remediation can lead to overcoming difficulties.

Explanations for the phenomena of the escalation of personal qualities in association with other difficulties include that the students get defensive about their problems, they use denial or try to cover up their shortcomings and they work at ways to avoid detection of their problems.

Educational significance. The overwhelming conclusion from this study is that in most cases the problem students did encounter repeated difficulties with the same dimensions. This finding leads to four significant educational recommendations. These have been discussed in the literature, but without much change in practice. This study further supports the need to implement these recommendations. 1) Students must be evaluated on several dimensions other than knowledge during the preclerkship phase of their training [17,18]). 2) This multifaceted evaluation needs to be on-going with an emphasis on formative as well as summative evaluation [18-20]. 3) Difficulties must be documented early; faculty and students must be prepared to remediate problems once they are identified [8,10,12,18]. 4) Previous evaluation information should be made available to faculty in a judicious manner [8,10]. If problem students had been more forthcoming in discussing their own shortcomings with subsequent faculty or with advisers, they might have been offered more remedial guidance and might have avoided some of their repeated problems.

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TABLE 1

Concerns and progress of 13 Problem Students

Number of times each student encountered difficulty with each dimension

Problem Students (letter id's)

Dimension	a	b	c	d	e	f	g	h	i	j	k	l	m
Problem Solving	3	4	2	8	2	2	3	2	1	2	0	5	5
Knowledge	1	4	3	4	2	3	1	1	1	2	1	3	5
Critical Appraisal	5	4	2	2	1	0	0	0	1	1	1	2	0
Clinical Skills	1	4	4	2	2	1	0	3	0	2	1	7	4
Learning Skills	0	4	3	2	2	1	0	2	0	1	1	2	2
Personal Qualities	1	2	3	2	3	1	1	1	0	2	1	5	5
Totals	**11**	**22**	**17**	**20**	**12**	**8**	**5**	**9**	**3**	**10**	**5**	**24**	**21**

Other data about these students

	a	b	c	d	e	f	g	h	i	j	k	l	m
Leave of Absence	n	n	n	n	n	n	n	y	n	y	n	n	n
Remedial work	n	y	y	y	n	n	y	n	n	y	n	n	y
Graduation delay yes = # months	n	6	12	18	18	n	12	n	n	18	n	n	n
Pass LMCC first try	y	n	y	y	y	y	n	n	y	y	y	y	y

TABLE 2

Concerns and Progress of 13 Problem Students

Number of times students encountered difficulty with each dimension and comparison to the cohort sample

	Problem Students			Cohort (n=597)		
	Pre Clerk	Clerk	Total	Pre Clerk	Clerk	Total
Problem Solving	16	23	39	5	15	20
Knowledge	9	22	31	7	12	19
Critical Appraisal	14	5	19	4	2	6
Clinical Skills	15	16	31	3	18	31
Learning Skills	8	12	20	4	7	11
Personal Qualities	12	15	27	10	11	21
Grand Total	74	93	167	43	65	108

Average Number of Concerns Per Problem Student		Average Number of Concerns Per Cohort Student
Perclerkship	14.8	0.014
Clerkship	15.5	0.018
Overall	15.18	

TABLE 3

Number of concerns/dimension/unit

	PS	K	CA	CS	LS	PQ
Unit 1	6	6	4	8	5	6
Unit 2	3	5	4	5	3	3
Unit 3	4	1	2	7	3	2
Unit 4	6	6	2	3	3	4
Unit 5	4	3	5	5	3	7
Med	6	8	3	7	6	5
FM	6	3	4	4	3	6
Sur	6	7	2	4	4	4
Ped	3	2	0	2	0	5
Psy	6	6	3	3	6	5
O–G	5	4	2	2	3	2

TABLE 4

REPETITION OF SAME CONCERN BY DIMENSION WITH SAME STUDENT

number of times same concern was identified	problem solving	know-ledge	critical appraisal	clinical skills	learning skills	personal qualities
2x	5	2	2	3	5	3
3x	2	3	0	1	1	2
4x	1	2	1	3	1	0
5x	2	1	1	0	0	2
6x	0	0	0	0	0	0
7x	0	0	0	1	0	0
8x	1	0	0	0	0	0

FIGURE 1

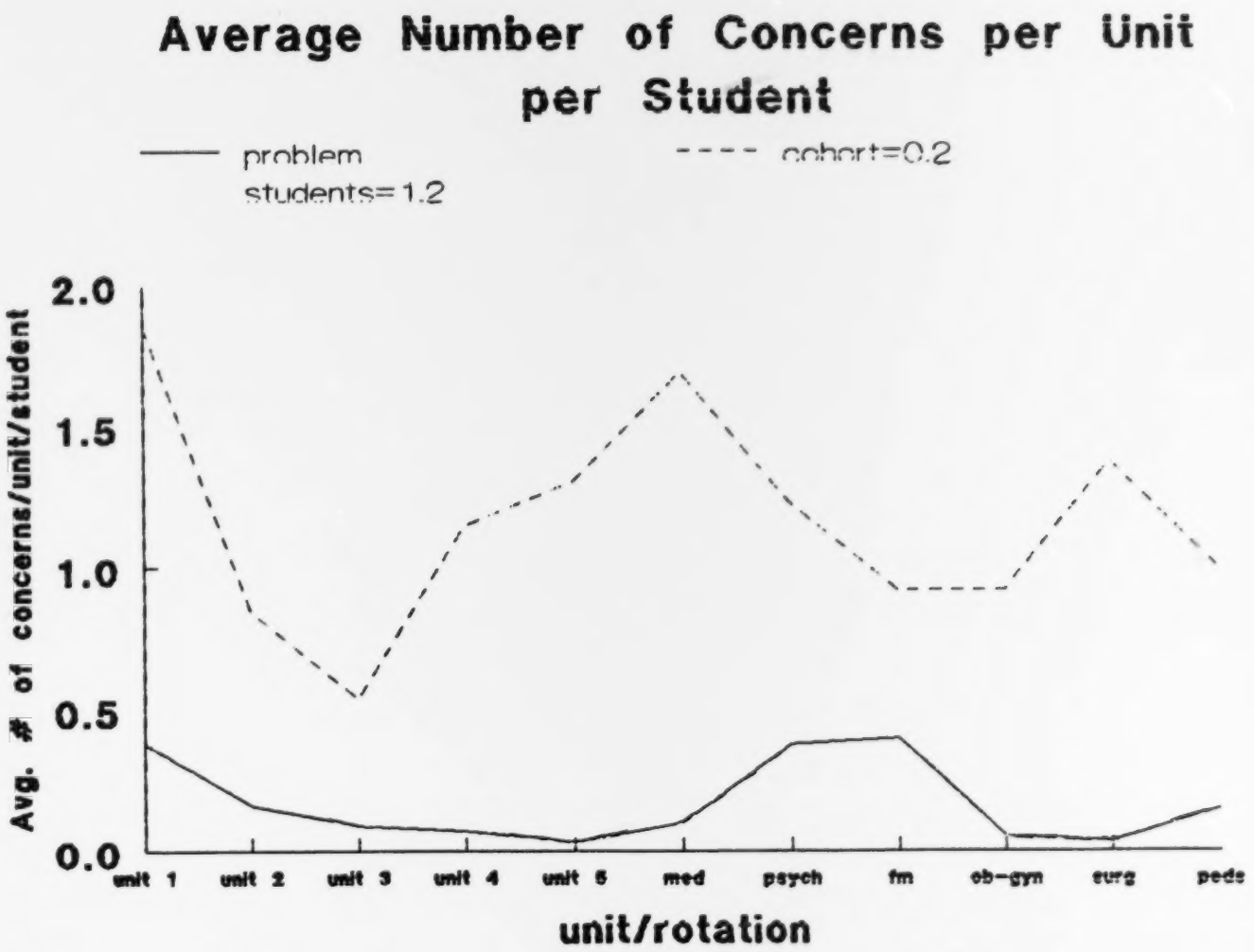
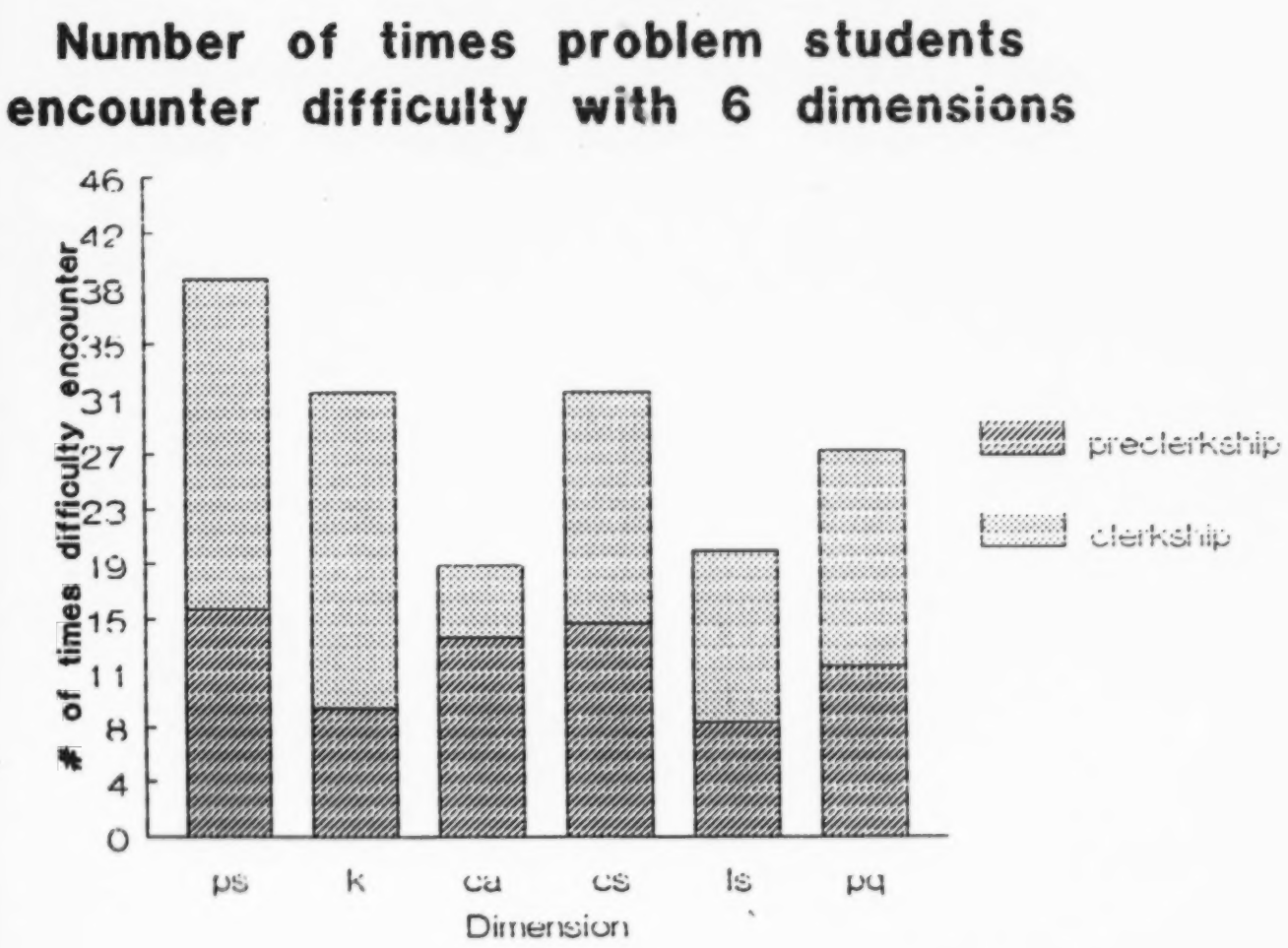

Average Number of Concerns per Unit per Student
problem students=1.2
cohort=0.2
Avg. # of concerns/unit/student
2.0
1.5
1.0
0.5
0.0
unit 1
unit 2
unit 3
unit 4
unit 5
med
psych
fm
ob-gyn
surg
peds
unit/rotation

FIGURE 2


Number of times problem students encounter difficulty with 6 dimensions
# of times difficulty encounter
46
42
38
35
31
27
23
19
15
11
8
4
0
ps
k
ca
cs
ls
pq
Dimension
preclerkship
clerkship